

ERRATA

Notification No.16
Errata No.1/IRC:SP:114/November, 2018 (Effective from 31st January, 2019)
To
IRC:SP:114-2018 “Guidelines for Seismic Design of Road Bridges”

Sl. No.	Clause No. & Page No.	Existing	Modified
	Contents - Chapter-6, Title	Seismic Analysis Methods	General Design Provisions
1.	Contents - Chapter-8, Title of section 8.5	Bearings, Seismic connection & Experience Joints	Bearings, Seismic connection & Expansion Joints
2.	Contents – Title of Appendix A-3	Illustration of Seismic Acceleration Method Preamble	Illustration of Capacity Design
3.	2.3, iii. (Page 6)	The dynamic earth pressures on abutments during earthquakes shall not be considered in Zones II and III.	The dynamic earth pressures on abutments, wing walls and return walls/retaining walls during earthquakes shall not be considered in Zones II and III.
4.	4.2.4, vi. (Page 27)	The shear force for over strength moments in case of cantilever piers shall be calculated as M_{RD}/h , “h” is height shown in Fig 7.1 in Chapter 7. In case of portal type pier capacity of all possible hinges need to be considered.	The shear force for over strength moments in case of cantilever piers shall be calculated as M_o/h , where “h” is height shown in Fig 7.1 in Chapter 7. In case of portal type pier capacity of all possible hinges need to be considered.
5.	4.8, ii. (Page 30 & 31)	 The total force shall be evaluated by Eq.4.2 $F = C_e \times \alpha_h \times W \quad \text{Eq. (4.2)}$ Where : C_e = A coefficient given in Table 4.4 as a function of ratio of height of submerged portion of pier (H) to Radius of enveloping cylinder R_e α_h = Design horizontal seismic coefficient as given in IRC 6 – 2017 W = Weight of the water of the enveloping cylinder The pressure distribution is shown in Fig. 4.2. Values of C_1, C_2, C_3 and C_4 are stated in Table 4.5	 The total force shall be evaluated by Eq.4.2 $F = C_e \times A_h \times W \quad \text{Eq. (4.2)}$ Where: C_e = A coefficient given in Table 4.4 as a function of ratio of height of submerged portion of pier (H) to Radius of enveloping cylinder R_e A_h = Design horizontal seismic coefficient W = Weight of the water of the enveloping cylinder The pressure distribution is shown in Fig. 4.2. Values of C_1, C_2, C_3 and C_4 are stated in Table 4.5
6.	5.2.1 (Page 34)	For most of the structures of low to medium heights with small span and small length of bridge, elastic seismic acceleration method (seismic coefficient method) is adequate. In this method structure is analysed its fundamental (single) mode of vibration.	For most of the structures of low to medium heights with small span and small length of bridge, elastic seismic acceleration method (seismic coefficient method) is adequate. In this method structure is analysed in its fundamental mode of vibration.
7.	5.2.2 (Page 37)	 The forces are obtained for each mode by use of response spectrum as given in Fig 5.1 (b) above and	 The forces are obtained for each mode by use of response spectrum as given in Fig 5.1 (b) above and

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		$\frac{S_a}{g} = \begin{cases} \text{For rocky or hard soil sites : } \begin{cases} 1 + 15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.40 \text{ s} \\ 1/T & 0.40 \text{ s} < T < 4.00 \text{ s} \\ 0.25 & T > 4.00 \text{ s} \end{cases} \\ \text{For medium stiff soil sites : } \begin{cases} 1 + 15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.55 \text{ s} \\ 1.36/T & 0.55 \text{ s} < T < 4.00 \text{ s} \\ 0.34 & T > 4.00 \text{ s} \end{cases} \\ \text{For soft soil sites : } \begin{cases} 1 + 15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.67 \text{ s} \\ 1.67/T & 0.67 \text{ s} < T < 4.00 \text{ s} \\ 0.42 & T > 4.00 \text{ s} \end{cases} \end{cases}$	$\frac{S_a}{g} = \begin{cases} \text{For rocky or hard soil sites : } \begin{cases} 1 + 15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.40 \text{ s} \\ 1/T & 0.40 \text{ s} < T < 4.00 \text{ s} \\ 0.25 & T > 4.00 \text{ s} \end{cases} \\ \text{For medium stiff soil sites : } \begin{cases} 1 + 15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.55 \text{ s} \\ 1.36/T & 0.55 \text{ s} < T < 4.00 \text{ s} \\ 0.34 & T > 4.00 \text{ s} \end{cases} \\ \text{For soft soil sites : } \begin{cases} 1 + 15T & T < 0.10 \text{ s} \\ 2.5 & 0.10 \text{ s} < T < 0.67 \text{ s} \\ 1.67/T & 0.67 \text{ s} < T < 4.00 \text{ s} \\ 0.42 & T > 4.00 \text{ s} \end{cases} \end{cases}$
8.	5.3 (Page 38)	In bridges where pier height are high, bridge has abrupt or unusual changes in mass, stiffness or geometry along its span and has large differences in these parameters between adjacent supports, special seismic devices such as dampers, isolator shock transmission unit etc. are provided and where the large spatial variation need to considered than time history method should be used. The dynamic analysis of a bridge by time history method may be carried out using direct step-by-step method of integration of equations of motion suitable steps small enough to include response of highest modes of vibration.	In bridges where pier heights are high, bridge has abrupt or unusual changes in mass, stiffness or geometry along its span and has large differences in these parameters between adjacent supports, special seismic devices such as dampers, isolator, shock transmission unit etc. are provided and where the large spatial variation need to be considered, then time history method should be used. The dynamic analysis of a bridge by time history method may be carried out using direct step-by-step method of integration of equations of motion with suitable steps which are small enough to include response of highest modes of vibration.
9.	8.2, 1st Para, last line, (Page 57)	The superstructure shall be designed for the design seismic forces calculated based on various analysis methods specified in Chapter 6 in combination with other appropriate loads. The effect of vertical seismic component is particularly important in Superstructure and needs to be investigated in situations mentioned in clause 5.3 under “General Design Provisions”.	The superstructure shall be designed for the design seismic forces calculated based on various analysis methods specified in Chapter 6 in combination with other appropriate loads. The effect of vertical seismic component is particularly important in Superstructure and needs to be investigated in situations mentioned in clause 4.2.1 .
10.	9.2.1, ii. (Page 78)	Steel members shall be so designed and detailed as to give them adequate strength, stability and ductility to resist severe earthquakes in all seismic zones classified in IRC:6 without collapse.	Steel members shall be so designed and detailed as to give them adequate strength, stability and ductility to resist severe earthquakes in all seismic zones classified in Chapter - 4 without collapse.
11.	9.2.2 (Page 79)	Special braced/moment frames defined in (i) (b,c and (ii)b above, are detailed to exhibit higher ductility and can be used in any seismic zone. Ordinary concentrically braced frames and Ordinary Moment Frame (OMF) shall not be used in seismic zones IV and V and for bridges with importance factor greater than unity ($I > 1.0$) in seismic zone III. Provisions for eccentrically Braced Frame (EBF) are not covered in these guidelines and specialist literature may be referred to for detailing of such frames.	Special braced/moment frames defined in (i) (b,c and (ii)b above, are detailed to exhibit higher ductility and can be used in any seismic zone. Ordinary concentrically braced frames and Ordinary Moment Frame (OMF) shall not be used in seismic zones IV and V and for bridges with importance factor greater than unity ($I > 1.0$) in seismic zone III. Provisions for eccentrically Braced Frame (EBF) are not covered in these guidelines and specialist literature may be referred to for detailing of such frames.
12.	9.2.6.1, (Page 81)	- The provisions in this section apply for diagonal, X-bracing, V and inverted V-type bracing in concentrically braced frames. - For eccentrically braced frames (EBF), specialist literature may be referred.	a. The provisions in this section apply for diagonal, X-bracing, V and inverted V-type bracing in concentrically braced frames. b. For eccentrically braced frames (EBF), specialist literature may be referred.

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		• K-bracing shall not be permitted in systems to resist earthquake. In K-bracing system, bracings are connected in the middle of an axial force carrying member and any unbalance in lateral force at joint due to failure of one brace may result in bending of the member leading to failure of member. • Along any line of bracing, braces shall be provided such that for lateral loading in either direction, the tension braces will have to resist between 30 to 70 per cent of the total lateral load. • The concentrically braced frames should be designed to resist all gravity loads without considering the additional strength provided by bracings/ diagonals of bracing system. • Concentrically braced frames shall be so designed that yielding of the diagonals in tension takes place before yielding failure of connections and buckling of main bending (beam) and compression (column) members. • The bracing members shall be so designed that gross area yielding and not the net area rupture would govern the design tensile strength. • For all built-up braces, the spacing of tack fasteners shall be such that the unfavourable slenderness ratio of individual element, between such fasteners, shall not exceed 0.4 times the governing slenderness ratio of the brace itself. Bolted connections shall be avoided within the middle one-fourth of the clear brace length (0.25 times the length in the middle). • The connection should be checked for tension rupture and block shear for the load determined in respective clause. • The connection shall be designed to withstand a moment of 1.2 times the full plastic moment of the braced section about the buckling axis. • Gusset plates shall be checked for buckling out of their plane.	c. K-bracing shall not be permitted in systems to resist earthquake. In K-bracing system, bracings are connected in the middle of an axial force carrying member and any unbalance in lateral force at joint due to failure of one brace may result in bending of the member leading to failure of member. d. Along any line of bracing, braces shall be provided such that for lateral loading in either direction, the tension braces will have to resist between 30 to 70 per cent of the total lateral load. e. The concentrically braced frames should be designed to resist all gravity loads without considering the additional strength provided by bracings/ diagonals of bracing system. f. Concentrically braced frames shall be so designed that yielding of the diagonals in tension takes place before yielding failure of connections and buckling of main bending (beam) and compression (column) members. g. The bracing members shall be so designed that gross area yielding and not the net area rupture would govern the design tensile strength. h. For all built-up braces, the spacing of tack fasteners shall be such that the unfavourable slenderness ratio of individual element, between such fasteners, shall not exceed 0.4 times the governing slenderness ratio of the brace itself. Bolted connections shall be avoided within the middle one-fourth of the clear brace length (0.25 times the length in the middle). i. The connection should be checked for tension rupture and block shear for the load determined in respective clause. j. The connection shall be designed to withstand a moment of 1.2 times the full plastic moment of the braced section about the buckling axis. k. Gusset plates shall be checked for buckling out of their plane.
13.	9.2.7.3, Equation in 3rd para, (Page 87)	Formula for 't' is given as: $t \geq (d_p + d_p) / 90$	The formula for 't' should be changed as: $t \geq (d_p + b_p) / 90$
14.	9.2.7.4, (Page 88)	9.2.7.4 Column Bases	9.2.8 Column Bases

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15.	APPENDIX-A-3, Title (Page 117)	ILLUSTRATION OF ELASTIC SEISMIC ACCELERATION METHOD PREAMBLE	ILLUSTRATION OF CAPACITY DESIGN
16.	APPENDIX-A-3 (Page 122)	Design Flexural Strength along Transverse Direction, $M_{RD,L}$	Design Flexural Strength along Transverse Direction, $M_{RD,T}$
17.	APPENDIX-A-3 (Page 123)	As per clause 7.2.4.2(a) the over strength moment..... Over-strength factor for concrete substructure $=\gamma_o$. As per clause 7.2.4.2 (b) of this guideline, ...	As per clause 7.3.4.2(a) the over strength moment..... Over-strength factor for concrete substructure $=\gamma_o$. As per clause 7.3.4.2 (b) of this guideline, ...

Notification No.17

Amendment No.7/IRC:112/November, 2018 (Effective from 31st January, 2019)

To

IRC:112-2011 “Code of Practice for Concrete Road Bridges”

S. No	Clause No. Page No.	For	Read												
1	4.1 (Page 16)	Concrete road bridges including foot bridges in India	Concrete road bridges, foot bridges and culverts												
2	5.8.1, (Page 25)	“The following table indicates the ‘design service life’ of some common types of bridges.”	“For Design service life of structures, reference may be made to provisions of IRC 5. Unless otherwise specifically classified by Owner, all structures shall be designed for a useful service life of 100 years												
3	Table 5.1, (Page 26)	As it exists	Delete Table 5.1												
4	Table 6.1 titled “Grades of Reinforcing Steel” (Page 29)	<table><tr><th>Types of Steel</th><th>Grade / Designation</th></tr><tr><td>Mild Steel (MS)</td><td>Grade-1</td></tr><tr><td>High Yield Strength deformed Steel (HYSD)</td><td>Fe 415 Fe415D Fe500 Fe500D Fe550 Fe550D Fe600</td></tr></table>	Types of Steel	Grade / Designation	Mild Steel (MS)	Grade-1	High Yield Strength deformed Steel (HYSD)	Fe 415 Fe415D Fe500 Fe500D Fe550 Fe550D Fe600	<table><tr><th>Types of Steel</th><th>Grade / Designation</th></tr><tr><td>Mild Steel (MS)</td><td>Grade-1</td></tr><tr><td>High Strength deformed Steel (HSD)</td><td>Fe 415 Fe415D Fe415 S Fe500 Fe500D Fe500 S Fe550 Fe550D Fe600</td></tr></table>	Types of Steel	Grade / Designation	Mild Steel (MS)	Grade-1	High Strength deformed Steel (HSD)	Fe 415 Fe415D Fe415 S Fe500 Fe500D Fe500 S Fe550 Fe550D Fe600
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5	6.4.1(c) (Page 36)	(c) High Performance Concrete is similar to standard concrete but contains additional one or more mineral admixtures providing binding characteristics and partly acting as inert filler material which increases its strength, reduce its porosity and modify its other properties in fresh as well as hardened condition. Concretes upto Grade M90 are included in this type.	High Performance Concrete (HPC) is one, whose ingredients, proportions and production methods are specifically chosen to meet special performance and uniformity requirements that cannot be always achieved routinely by using only conventional materials, like, cement, aggregates, water and chemical admixtures, and adopting normal mixing, placing and curing practices. Use of mineral admixtures is required. These performance requirements can be high strength, high early strength, high workability (including Self-Compacting Concrete), low permeability and high durability for severe service environments, etc. or combinations thereof. Production and use of such concrete in the field necessitates high degree of												